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Further observations on the nesting behavior of *Penepodium luteipenne* (Hymenoptera, Sphecidae)

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Abstract

Stereotyped motor patterns related to oviposition and prey transport of the cockroach-hunting solitary wasp *Penepodium luteipenne* (Fabricius, 1804) are described. Notes on provision, structure and aggregation of the nests are also provided. The fieldwork was carried out in the Biological Station of Santa Lúcia, an area covered with Atlantic Forest in Southeastern Brazil.

Keywords

Biology, stereotyped motor patterns, Podiini, *Podium*, *Trigonopsis*, *Dynatus*

Introduction

The neotropical genus *Penepodium* Menke *in* Bohart & Menke, 1976, with 22 recognized species (Pulawski 2015a), is part of a monophyletic group of four genera of cockroach-hunting wasps (Ohl 1996) in the tribe Podiini (Pulawski 2015b). Because the biology of this genus is poorly known, we have studied *Penepodium luteipenne* (Fabricius, 1904) in forested areas of Rio de Janeiro State, southeastern Brazil (Buys 2001, 2009, 2011, 2012). Here, we present further observations on the reproductive behavior of this species.

Methods

The observations were carried out in the Biological Station of Santa Lúcia, an area with 440 hectares of preserved Atlantic Forest in city of Santa Teresa (19°56'10"S and 40°36'06"W), Espírito Santo State, southeastern Brazil. Six nesting females were observed in 2008 and 2009; another female was observed and filmed in details in 2012 during two consecutive days. Voucher specimens were deposited in the Entomological Collection of the Instituto Oswaldo Cruz, Rio de Janeiro, RJ, Brazil.

Results and discussion

Nest provision, structure and aggregation

The females provided the nests with one to four nymphs or adults of a species of the genus *Poeciloderrhis* Stål, 1874 (Blattodea: Blaberidae). The nests were unicellular and consisted of not branched vertical tunnels, with a narrower canal that leads the opening to the cell (Fig. 1), similar to those described by Buys (2012). The nests were found in compacted clay soil, in open sites, exposed to the sun.

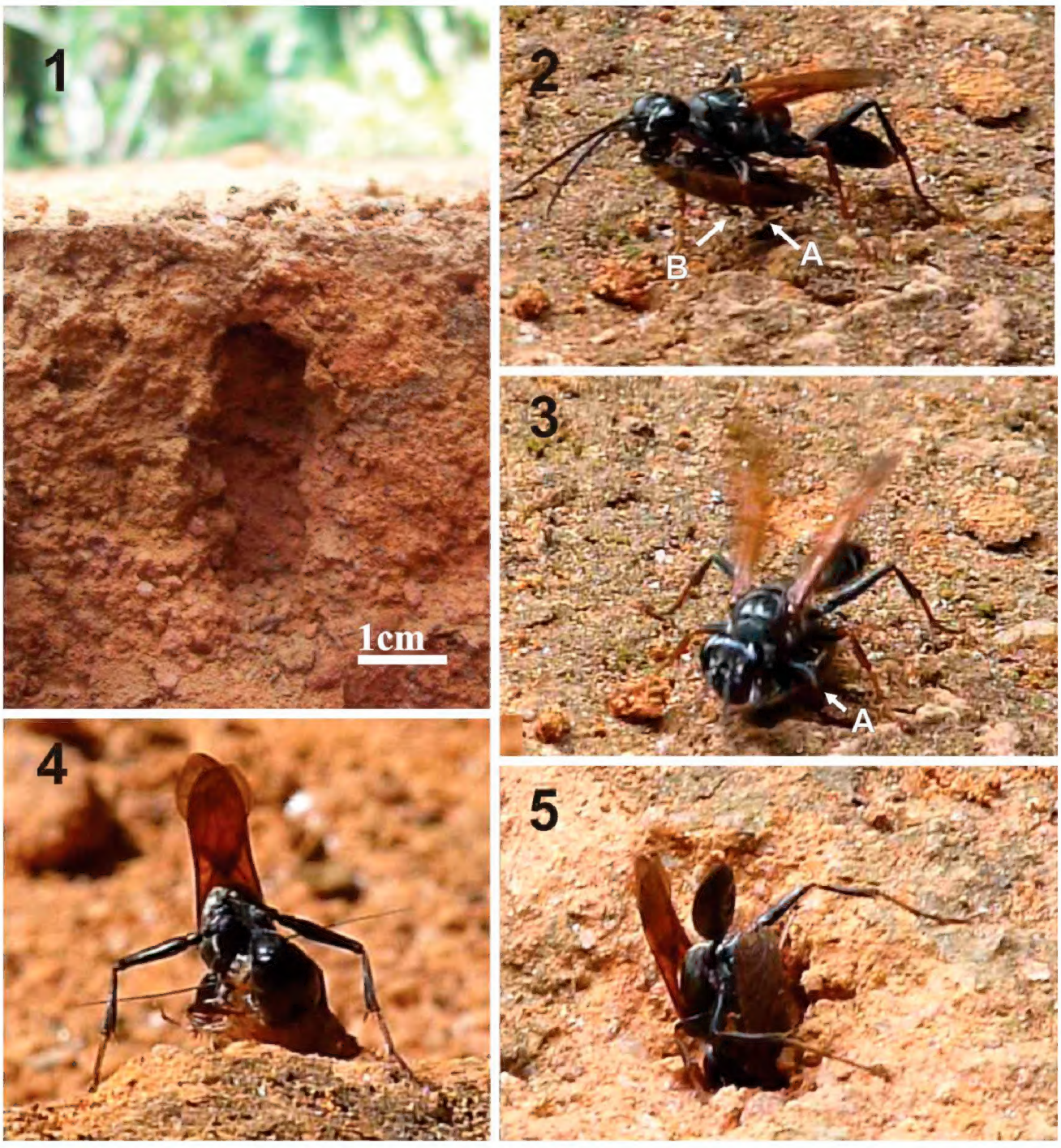
At one nesting site, within an area of about 1.5 m^2, we excavated 16 nests, whose entrances were separated from one another by 9–129 cm. Since females *P. luteipenne* dig several nests gregariously and defend the nesting site against conspecific females and other walking insects (Buys 2012), it is possible that all of these nests, or at least part of them, has been dug by the same female. Measurements of some of these nests are showed in Table 1.

Prey-carrying behavior

The carrying prey mechanism of *P. luteipenne* was previously described (Buys 2012), but herein a new noteworthy observation is added: females carry small prey by holding the bodies of the prey with one midleg and one foreleg (Figs 2–3), besides grasping the prey antennae with the mandibles. This represents a relatively unusual form of transport.

Oviposition behavior

To our earlier observations, we can now add the following. While ovipositing, a female *P. luteipenne* uses one middle leg to move the forelegs of the prey aside, aiding it to lay eggs in hidden and protected places behind the forecoxae of the prey (Fig. 4). At the same time, the female extends her long hind legs and raises the posterior portion of the prey (Fig. 4), so she can use her middle legs to manipulate the prey. The female also uses her hind legs to anchor her body when she places prey inside the nest (Fig. 5).



Figures 1–5. Nesting behavior of a female *Penepodium luteipenne*. **1** Nest in profile, the narrower canal that the leads the opening to the cell is entirely closed with a plug of earth **2–3** carrying of the prey (A = left foreleg, B = right middle leg) **4** oviposition **5** deposition of the prey inside the nest.

Table 1. Nest length and cell width of nests of *Penepodium luteipenne*.

Nest number	Nest length (cm)	Cell width (cm)
1	5.5	-
2	4.9	-
3	5.0	1.2
4	5.0	1.1
5	5.0	1.4
6	4.8	1.0
7	4.7	-
8	4.8	1.4
9	5.0	-
10	4.9	-
11	4.5	-

Buys (2012) already discussed that the oviposition outside the nest may be due to the lack of space inside her small nests to the female executing the stereotyped sequence of ovipositing behavior; the present observation reinforces this hypothesis.

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